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First record of the genera *Diaparsis* Förster and *Phradis* Förster (Hymenoptera, Ichneumonidae, Tersilochinae) from Mexico

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Abstract

In this paper, one species of *Diaparsis* Förster (*D. splendens* Horstmann) is recorded and two species of *Phradis* Förster (*P. bufalosus* **sp. n.** and *P. nanacamilpus* **sp. n.**) are described from Mexico. Both genera are extremely rare in the Mexican fauna, being represented by single specimens from a large amount of ichneumonids examined in many Mexican and USA collections. A partial identification key to North American species of *Phradis* is given. Colour photographs and morphological remarks on *D. splendens* are provided.

Resumen

Se registran para México una especie de *Diaparsis* Förster (*D. splendens* Horstmann) y se describen dos especies nuevas de *Phradis* Förster (*P. bufalosus* **sp. n.** and *P. nanacamilpus* **sp. n.**) de México. Ambos géneros son extremadamente raros en la fauna mexicana, siendo representados por especímenes únicos entre una gran cantidad de ichneumónidos examinados en varias colecciones mexicanas y de Estados Unidos. Se elaboró una clave parcial para la identificación de las especies norteamericanas de *Phradis*. Se incluyen fotografías a color y comentarios sobre la morfología de *D. splendens*.

Keywords

Baja California, Tlaxcala, Nearctic region, North America, fauna, new species, taxonomy, parasitoids, key

Introduction

Tersilochinae is a moderately large subfamily of parasitoid wasps (Hymenoptera: Ichneumonidae) distributed worldwide and represented by about 500 described species in 23 genera (Yu et al. 2016, Khalaim pers. obs.). The majority of host records of tersilochine species are from beetle larvae (Yu et al. 2016) but some taxa are known as parasitoids of non-coleopteran hosts, e.g. mining larvae of Eriocraniidae (Lepidoptera) (Jordan 1998), larvae of xyelid sawflies (Hymenoptera: Xyelidae) in staminate pine cones (Khalaim and Blank 2011, Horstmann 2013a) and gall-forming *Pontania* spp. on willows and leaf-folder sawfly of the genus *Phyllocolpa* Benson (Hymenoptera: Tenthredinidae) (Kopelke 1994, 2011).

The Mexican fauna of Tersilochinae is poorly known, in spite of several recent studies comprising records of the genera *Allophrys* Förster (Horstmann 2010), *Aneuclis* Förster (reported as *Sathropterus* Förster in Khalaim et al. 2015, synonymized by Khalaim 2018), *Barycnemis* Förster (Khalaim 2002a), *Gelanes* Horstmann (Khalaim and Ruíz-Cancino 2017), *Labilochus* Khalaim (Khalaim et al. 2017) and *Stethantyx* Townes (Khalaim and Ruíz-Cancino 2013) from Mexico. All these genera are represented in the Mexican fauna by single or several species, except for the large Neotropical genus *Stethantyx* which comprises at least 11 species in Mexico (Khalaim and Ruíz-Cancino 2013, Khalaim unpubl.).

The aim of this work is to describe two Mexican species of *Phradis* and report one species of *Diaparsis*, representing first record of these genera from Mexico. A portion of the identification key to North American species of *Phradis* is also provided.

Material and methods

Among a large number of ichneumonids examined in many Mexican (Universidad Autónoma de Tamaulipas, Cd. Victoria; Instituto de Biología, Universidad Nacional Autónoma de México, D.F., further **UNAM**; Universidad Autónoma de Nuevo León, Monterrey; Universidad Autónoma de Estado Morelos, Cuernavaca; Instituto Politécnico Nacional, Oaxaca; Universidad Veracruzana, Xalapa, Veracruz) and some United States collections (Essig Museum of Entomology, University of California, Berkeley, further **EMEC**; Texas A&M University, College Station, Texas; the Townes collection, recently moved to the Utah State University, Logan, Utah; Florida State Collection, Gainesville, Florida), only one specimen of *Diaparsis* and two specimens of *Phradis* were found.

Types of 17 Nearctic species of *Phradis* described by Horstmann (2013b) were examined by the senior author during his visit to the Zoologische Staatssammlung (Munich, Germany) in May 2016, and compared with the two Mexican species described in this paper.

Morphological terminology follows that of Townes (1969) with changes according to Khalaim (2011). Photographs were taken in the Zoological Institute RAS (St. Petersburg, Russia), with a Canon EOS 70D digital camera attached to an Olympus SZX10 stereomicroscope. Images were assembled with Helicon Focus 6 Pro software.

Taxonomy

Genus *Diaparsis* Förster, 1869

Type species. *Ophion nutritor* Fabricius, 1804.

Large genus of almost worldwide distribution (unknown only from the Neotropical region). Comprises 12 species in the Nearctic region, including 11 native species and one introduced from Europe into the United States and established there (Horstmann 2012).

The genus lacks examined materials from Mexico except for one rare species described from California by Horstmann (2012) and recorded here from a low-mountainous region in Northwest Mexico.

Diaparsis (*Diaparsis*) *splendens* Horstmann, 2012

Figs 1–6

Remarks. The female from Mexico corresponds well with the original description and illustrations of this species (Horstmann 2012: 137). A brief description of the specimen from Mexico is provided below. Colour photographs of this species are provided for the first time.

Female (Mexico): body length 4.0 mm, fore wing length 3.25 mm; flagellum (Fig. 1) slightly clavate, with 17 flagellomeres, proportions of flagellomeres as in original description; head strongly rounded posterior to eyes (Fig. 1); temple 0.8 times as long as eye width; clypeus (Fig. 2) 3.4 times as broad as long, separated from face by very shallow impression mediodorsally and by quite distinct furrow laterally; propodeum mediodorsally (Fig. 3) without distinct basal keel, with weak longitudinal wrinkles, basal part of propodeum half as long as apical area; first abscissa of radius (Rs+2r) 1.15 as long as width of pterostigma; first tergite dorsally polished, 2.2 times as long as posteriorly broad; glymma large and deep, situated more or less in centre of first tergite (Fig. 4); second tergite slightly transverse, 0.95 as long as anteriorly broad (Fig. 5); ovipositor slender, weakly and evenly bent upwards over its total length, with conspicuous nodus apically (Fig. 6, arrow), its sheath 2.5 times as long as first tergite.

This species resembles the Holarctic genus *Gelanes* Horstmann as it has a smooth or shallowly sculptured head and mesosoma, dorsally polished first metasomal tergite with a broad postpetiole, deep glymma in the centre of the first tergite, transverse thyridial depressions, lacks a foveate groove on the mesopleuron, and was collected in the spring. Nevertheles, it possesses an isolated glymma, i.e. not joining by a furrow to the ventral part (Fig. 4), while the remaining characters also occur in the genus *Diaparsis*.

Material examined. 1 female (EMEC), Mexico, Baja California Norte [Baja California], Jaraguay Summit [29.33°N, 114.5°W, NW of Agua León], ex flowers Yucca peninsularis, 27 March 1973, coll. Doyen, "U.C. Berkeley EMEC 203, 505".

Figures 1–6. *Diaparsis splendens*, female (Mexico). **1** head with antenna and mesoscutum, dorsal view **2** head, front view **3** mesosoma, dorsal view **4** propodeum and metasoma, lateral view **5** postpetiole and second tergite, dorsal view **6** apex of ovipositor, lateral view.

Distribution. Southwestern USA (California), Northwestern Mexico (Baja California). First record of genus and species from Mexico.

Biology. Reared or collected from flowers of *Hesperoyucca whipplei* (Torr.) Baker ex Trel. [=*Yucca peninsularis*] (Agavaceae) in Mexico.

Genus *Phradis* Förster, 1869

Type species. *Thersilochus* (*Phradis*) *brevis* Brischke, 1880.

A moderately large genus with a predominantly Holarctic distribution and a few species known from the Afrotropical (Khalaim 2007) and Neotropical regions (Khalaim and Bordera 2012) and Australia (Khalaim 2017). About 40 species are known to occur in the Palaearctic region (Yu et al. 2016) and 18 species in the Nearctic region (Horstmann 2013b). Two undescribed species of *Phradis* were found in material from the State of Tlaxcala in Central Mexico. This is the first record of the genus from Mexico.

Phradis is found to be extremely rare in Mexico, being represented by two species, both known from a single female, collected from the same locality at 2830–2900 m in pine-oak forest. The two Mexican species easily differ from the 18 species occurring in the USA and Canada by the very long second metasomal tergite (see the key below).

Portion of the key to North American species of *Phradis*

1 Second metasomal tergite, in dorsal view, very long, 2.8–3.6 times as long as anteriorly broad. Central Mexico **2**

– Second metasomal tergite, in dorsal view, transverse to moderately long, 0.8–2.0 times as long as anteriorly broad. USA and Canada ....**18 species** (see identification key in Horstmann 2013b)

2 Second antennal flagellomere 2.5 times as long as broad (Fig. 8). Apical area of propodeum flat (Fig. 11). Second metasomal tergite 2.8 times as long as anteriorly broad (Fig. 12). Ovipositor with apex needle-shaped, without dorsal notch (Fig. 13); sheath 1.1 times as long as first tergite .....***P. bufalosus* sp. n.**

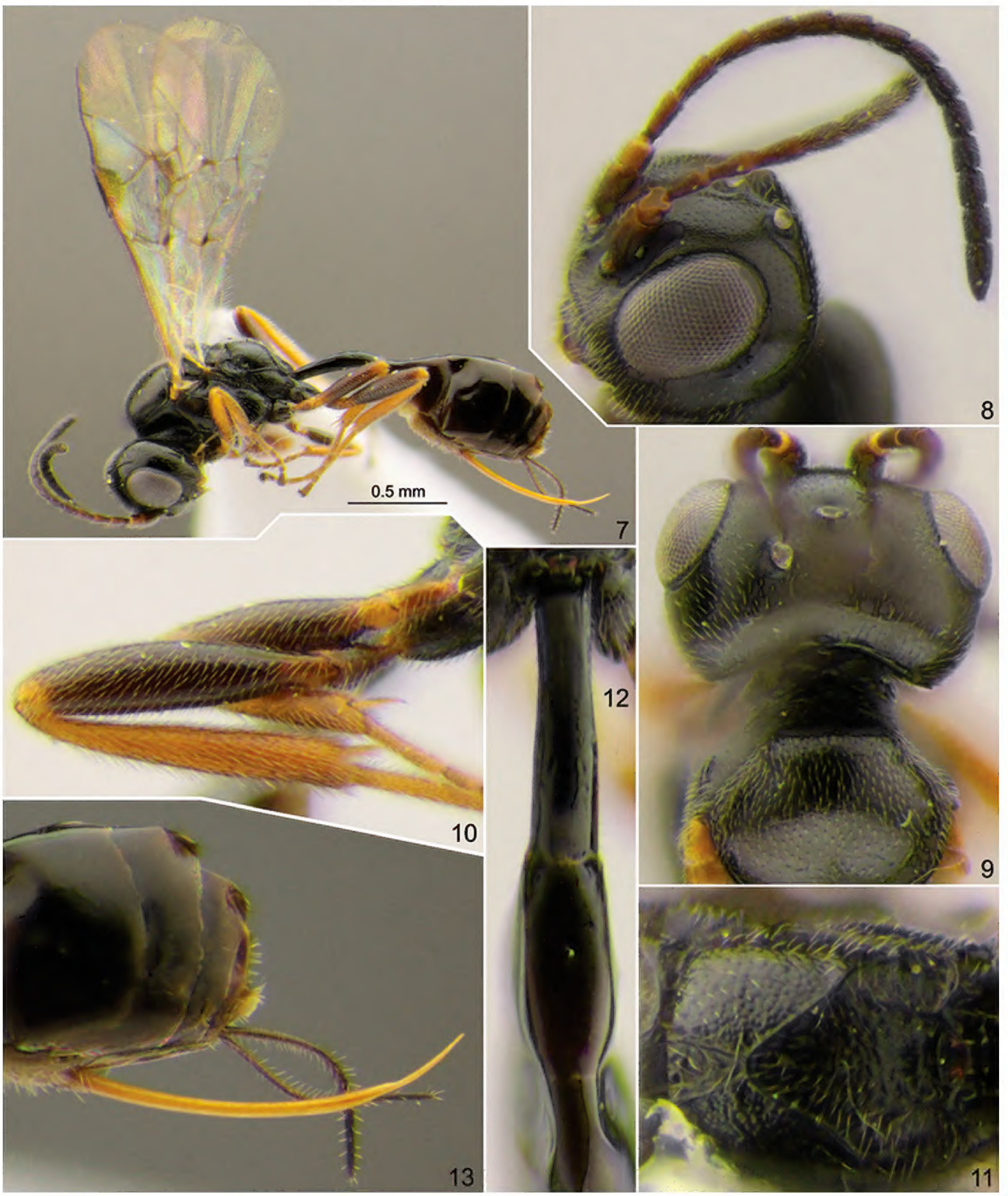
– Second antennal flagellomere 3.5 times as long as broad (Fig. 15). Apical area of propodeum impressed along midline (Fig. 20). Second metasomal tergite 3.6 times as long as anteriorly broad. Ovipositor evenly tapered apically, with weak but distinct dorsal subapical notch (Fig. 21); sheath 1.4 times as long as first tergite .....***P. nanacamilpus* sp. n.**

Phradis bufalosus Khalaim & Ruíz-Cancino, sp. n.

http://zoobank.org/2FD83281-5DDA-4BB5-9968-7AD188630EA7

Figs 7–13

Comparison. In the key to the Nearctic species of *Phradis* (Horstmann 2013b), *P. bufalosus* runs to *P. flavicoxa* Horstmann in couplet 9 but may be distinguished from this species by the head being weakly constricted behind the eyes (Fig. 9), dark legs (Fig. 10), smooth first metasomal tergite, long second tergite (Fig. 12) and a needle-shaped ovipositor apex (Fig. 13).



Figures 7–13. *Phradis bufalosus* sp. n., holotype female. **7** habitus, lateral view **8** head with antenna, lateral view **9** head and mesoscutum, lateral view **10** hind legs, lateral view **11** propodeum, dorsal view **12** base of metasoma, dorsal view **13** apex of metasoma with ovipositor, lateral view.

Morphologically and in colouration, *P. bufalosus* is very similar to *P. coriaceus* Horstmann, from which it differs by the temple being finely punctate on a smooth background (granulate, impunctate and dull in *P. coriaceus*) and longer second metasomal tergite (2.8 times as long as anteriorly broad in *P. bufalosus* and 1.8 times in *P. coriaceus* [measured from Fig. 21 in Horstmann 2013b: 73]).

Description. *Female*. Body length 2.5 mm. Fore wing length 1.85 mm.

Head, in dorsal view, 1.65 times as broad as long, weakly constricted and rounded posterior to eyes (Fig. 9); temple 0.8 times as long as eye width (Fig. 9). Eyes with short and rather dense setae. Clypeus lenticular in anterior view, 3.4 times as broad as long, weakly convex in lateral view, smooth, separated from face by sharp furrow, with fine scattered punctures in upper 0.3. Mandible weakly tapered at base, with upper and lower margins subparallel in apical 0.8; upper tooth distinctly longer than the lower. Malar space almost as long as basal mandibular width. Antennal flagellum (Fig. 8) with 14 flagellomeres, basally slender; second and third flagellomere 2.3–2.5 times and subapical flagellomeres 1.2–1.3 times as long as broad. Face with elongate median prominence in upper part. Face very finely punctate (punctures vanishing on medial prominence and laterally next to eyes and malar spaces), smooth between punctures and shining centrally, and very finely granulate and dull laterally. Frons very finely punctate on very finely granulate background (punctures partly hardly discernible because of granulation), weakly shining to dull. Vertex and temple with very fine but distinct punctures on smooth and shining background. Occipital carina complete, somewhat dipped mediodorsally.

Mesosoma predominantly finely granulate, impunctate, weakly shining to dull, except for mesoscutum which is very finely punctate on more or less smooth and shining background. Notaulus discernible as weak and short wrinkle on anterolateral side of mesoscutum. Scutellum with lateral longitudinal carinae at basal 0.2. Foveate groove absent, mesopleuron centrally almost smooth. Propodeal spiracle very small, separated from pleural carina by about 3.0 times diameter of spiracle. Propodeum with basal area strongly widened anteriorly, about 3.0 times broader anteriorly than posteriorly and almost half as long as apical area (Fig. 11); basal longitudinal carinae weak but distinct. Apical area flat, rounded anteriorly (Fig. 11); apical longitudinal carinae distinct posteriorly and weak anteriorly, not reaching transverse carina anteriorly.

Fore wing with second recurrent vein (2m-cu) interstitial. Intercubitus (2rs-m) long. First abscissa of radius (Rs+2r) slightly arcuate, longer than width of pterostigma. First and second abscissae of radius (Rs+2r and Rs) meeting at slightly acute angle (less than 90°). Metacarpus (R1) short, not reaching apex of fore wing (Fig. 7). Second abscissa of postnervulus represented by a short protrusion, thus brachial cell is widely open posteriorly. Hind wing with nervellus (cu1&cu-a) slightly reclivous.

Legs slender. Hind femur 4.3 times as long as broad and 0.9 times as long as tibia (Fig. 10). Tarsal claws not pectinate.

First tergite slender, 4.2 times as long as posteriorly broad (Fig. 8), smooth, with shallow striae laterally; tergite round in cross-section centrally, with lateral sides subparallel and petiole not separated from postpetiole in dorsal view (Fig. 12). Glymma absent. Second tergite about 2.8 times as long as anteriorly broad (Fig. 8). Thyridial depression almost 3.0 times as long as broad, with narrow groove extending from posterior end of thyridial depression along lateral margin of second tergite and reaching nearly its midlength. Ovipositor slender, weakly and nearly evenly bent upwards over its total length, with abruptly narrowed needle-shaped apex (Fig. 13); sheath 1.1 times as long as first tergite.

Head, mesosoma and first metasomal segment black. Palpi, mandible (teeth dark reddish brown), lower 0.7 of clypeus and tegula yellow to yellow-brown. Scape of antenna dark brown with narrow yellowish ring on distal end; pedicel yellow-brown; flagellum gradually darkening from brownish basally to black apically. Pterostigma brown. Fore leg brownish yellow with fore coxa dark brown and femur basally on dorsal side darkened with brown. Mid and hind legs with coxae brownish black, first and second trochanters brownish yellow (first trochanter darkened with brown), femora dark brown with extreme apex brownish yellow (Fig. 10), and tarsi brownish yellow. Metasoma posterior to first tergite and ovipositor sheath brownish black.

Male. Unknown.

Etymology. The species is named after the type locality, [Los] Búfalos.

Material examined. Holotype female (UNAM), Mexico, Tlaxcala, Nanacamilpa, Ejido Los Búfalos, N19°28', W98°35', bosque Pino-Encino, 2830–2900 m, Malaise trap, 4 April–3 May 2016, coll. Y. Marquez & A. Contreras.

Distribution. Central Mexico (Tlaxcala).

***Phradis nanacamilpus* Khalaim & Ruíz-Cancino, sp. n.**

http://zoobank.org/6047BF50-51DB-4229-90D2-62FB2162F068

Figs 14–21

Comparison. In the key to the Nearctic species of *Phradis* (Horstmann 2013b), *P. nanacamilpus* runs to couplet 10 but does not correspond with either side of the couplet as it has the mesopleuron very finely and sparsely punctate on a smooth background centrally, shallowly granulate peripherally (Fig. 19), dorsolateral area of propodeum without irregular wrinkles (Figs 18, 20), and ovipositor sheath 1.4 times as long as first tergite.

Description. *Female*. Body length 3.8 mm. Fore wing length almost 2.5 mm.

Head, in dorsal view, almost 1.7 times as broad as long, weakly constricted and weakly rounded posterior to eyes (Fig. 17); temple 0.7 times as long as eye width (Fig. 17). Eyes with short and rather dense setae. Clypeus (Fig. 16) lenticular in anterior view, 3.5 times as broad as long, almost flat in lateral view, smooth, separated from face by sharp furrow, with a few fine punctures next to upper and lower margins. Mandible weakly tapered at base, with upper and lower margins subparallel in apical 0.8; upper tooth distinctly longer than the lower. Malar space slightly shorter than basal mandibular width. Antennal flagellum (Fig. 15) with 14 flagellomeres, basally very slender; second and third flagellomere 3.0–3.5 times and subapical flagellomeres 1.4–1.6 times as long as broad. Face with weak median prominence in upper part. Face with very fine inconspicuous punctures (medial prominence impunctate), smooth between punctures and shining centrally, and very finely granulate and weakly shining laterally. Frons smooth and very fine punctate, laterally (next to eye orbits) very finely

Figures 14–21. *Phradis nanacamilpus* sp. n., holotype female. **14** habitus (without wings), lateral view **15** antenna, lateral view **16** head, front view **17** head, dorsal view **18** head, mesosoma and base of metasoma, lateral view **19** mesopleuron, postero-lateral view **20** propodeum, dorsal view **21** apex of metasoma with ovipositor, lateral view.

granulate and dull. Vertex and temple with very fine punctures on smooth and shining background. Occipital carina complete, flattened mediodorsally.

Mesosoma predominantly finely granulate, impunctate, dull; mesoscutum evenly finely punctate smooth and shining background; mesopleuron centrally more or less smooth and shining, with fine and sparse punctures, peripherally shallowly granulate and weakly shining to dull. Notaulus as a rather strong wrinkle on anterolateral side of mesoscutum. Scutellum with lateral longitudinal carinae at extreme base. Foveate groove weak and narrow, situated in centre of mesopleuron, slightly oblique, with fine and short transverse wrinkles (Fig. 19). Propodeal spiracle small, separated from pleural carina by about 4.0 times diameter of spiracle. Propodeum with basal area weakly widened anteriorly, twice broader anteriorly than posteriorly and almost 0.4 times as long as apical area (Fig. 20); basal longitudinal carinae weak but distinct. Apical area impressed along midline, rounded anteriorly (Fig. 20); apical longitudinal carinae distinct, reaching transverse carina anteriorly.

Fore and hind wing venation very similar to that in *P. bufalosus*. Fore wing with second recurrent vein (2m-cu) interstitial. Intercubitus (2rs-m) long. First abscissa of radius (Rs+2r) slightly arcuate, longer than width of pterostigma. First and second abscissae of radius (Rs+2r and Rs) meeting at slightly acute angle (less than 90°). Metacarpus (R1) short, not reaching apex of fore wing. Second abscissa of postnervulus incomplete, partly enclosing brachial cell posteriorly. Hind wing with nervellus (cu1&cu-a) weakly reclivous.

Legs slender. Hind femur 4.8 times as long as broad and 0.85 times as long as tibia. Tarsal claws not pectinate.

First tergite slender, almost 5.0 times as long as posteriorly broad, smooth, with very weak striae ventrolaterally; tergite round in cross-section centrally, with lateral sides subparallel and petiole not separated from postpetiole in dorsal view. Glymma absent. Second tergite 3.6 times as long as anteriorly broad. Thyridial depression very long and narrow, pointed posteriorly, extending in basal 0.4 of tergite. Ovipositor slender, weakly and nearly evenly bent upwards over its total length, evenly tapered apically, with weak but distinct dorsal subapical notch (Fig. 21); sheath 1.4 times as long as first tergite.

Head, mesosoma and first metasomal segment black. Palpi, mandible (teeth dark reddish brown) and tegula brownish yellow. Lower 0.7 of clypeus yellow-brown. Antenna brownish yellow basally to brownish black apically (Fig. 15). Pterostigma brown. Leg brownish yellow; mid and hind coxae darkened with brown; hind femur brown except base and apex. Metasoma posterior to first tergite dark brown.

Male. Unknown.

Etymology. The species is named after the type locality, Nanacamilpa.

Material examined. Holotype female (UNAM), Mexico, Tlaxcala, Nanacamilpa, Ejido Los Búfalos, N19°28', W98°35', bosque Pino-Encino, 2830–2900 m, Malaise trap, 3–30 June 2016, coll. Y. Marquez & A. Contreras.

Distribution. Central Mexico (Tlaxcala).

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